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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
PADGETT, MARIANNE L	
ART UNIT	PAPER NUMBER
1792	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/566,334	CHELLAPPA ET AL.	
	Examiner	Art Unit	
	MARIANNE L. PADGETT	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11/6/09, 9/25/07, 2/9/07, 1/26/06*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-49* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-49* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/25/7*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

1. The **disclosure** is **objected** to because of the following informalities:

For example, in [0002] not all the chemical formulas for disclosed gases are properly subscripted. Proofreading for similar errors throughout the specification is recommended

Appropriate correction is required.

Claims 1 & 31-32 are **objected** to because of the following informalities:

In **claim 1**, lines 1 and 7, see "6upon" which appears to be a typographical error.

In **claim 31**, see "a porous metal substrates" (emphasis added) which mismatches singular articles and plural noun, as well as changing substrate from singular to plural, so also appear to be a typographical error.

In **claim 1**, line 3 "a substrate" & in **claim 32** "a...substrate" should technically use the article --said-- or --the--, as the terms were previously introduced, but since this do not cause confusion in their claim sequences, so are considered objections, not rejections.

Appropriate correction is required.

2. **Claims 1-49** are rejected under 35 U.S.C. **112, second** paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In the claims, particularly **claims 1 & 29**, claiming the coating is "leak-tight" and at the same time, that it provides "premeance" or "transport" to hydrogen is self-contradictory or confusing and ambiguous. The examiner presumes that the intent is for the membrane to be selectively permeable to H or H_2(?), as suggested by calling it a H-separation membrane, but that is not what is actually claimed, since "leak-tight" does not specify anything is permitted to leak through, literally meaning nothing can leak through, hence can be considered to require preventing all diffusion or permutation through the coating, so is contradicted by the subsequent "premeance" limitation.

In **claim 29**, "membrane reformer" of the preamble is not commencerate in scope with body of the claim, which appears to only be directed to a substrate that transports H, no "reforming" or chemical reactions to get H_2. Given this confusing terminology, it is uncertain if this is a process or a product, hence for purposes of examination over art either option can be considered.

Use of **relative terms** that do not have clear metes and bounds in the claims, or in a definition in the description or in cited relevant prior art, is vague and indefinite. In the claims, see "low" in **claim 27** or "thin" in **claim 29**. Also, since the coating (or coated membrane) is clearly letting something through (H, H_2...?), "leak-tight" is also an unclear relative term, i.e. with respect to what?

In **claim 2** "said forming sep" as confusing because (1) no "step" was ever introduced; (2) there are two "forming" clauses in the independent claim, hence even only considering this part of the phrase, it is uncertain when the laser writing is being preformed. Would the laser writing be intended to be a species of thermal processing as described in claim 13? It would be logical as it is a thermal process, but claim 14 shows thermal processing as distinct from "forming" (again preceded by "steps"), thus what is actually intended is uncertain, especially when further considering Fig. 4A & B, where the laser direct write process is depositing ONTO the substrate, not treating a composition previously deposited! As presently written, no clear meaning can be determined for this claim. Also see **claim 14**, providing similar references "said steps... forming..."

In **claim 7**, it is uncertain when and where the "**diffusion barrier**" is being provided. Also, what is it preventing from diffusing or what is it a barrier to? Lacking a clear scope, "diffusion barrier" may also be considered a relative term, or very broad, since most solid layers will prevent something from diffusing through them. Also see **claims 8-9, 12 & 33**.

Note with respect to etching an unknown material, with a specified etchant, as in **claim 12**, where that material has a specified function (e.g. diffusion barrier) with respect to other unspecified somethings,

claiming etching of unknown compositions to create unspecified etching effects with a specific etchant, is fairly meaningless, as it is uncertain exactly what is being accomplished on what.

In **claim 11**, "said porous substrate" lacks any antecedent basis, as no such requirement was made in claims 3 or 1, from which 11 depends. Was the wrong dependents claimed, i.e. was claim 4 the intended dependence?

In **claim 34**, the claim of an etched barrier provides no clear structure to the product claim.

In **claims 10 or 35**, not all the techniques claimed appear to properly be species of "polishing' as plasma or vapor deposition of metal is NOT considered such. While such techniques may result in a coating of shiny metal or a very smooth or plannarized surface, that is NOT the same thing as "polishing" although the end result may be an analogous microstructure depending on what the substrate is made of, which for these claims is not specified.

Phrasing such as "less than about" is contradictory, since "about" includes values greater than given as well as below, but alternative language --less than or about-- may remove this ambiguity.

In **claims 15 or 47**, there are no "organics" necessarily present, as the applied composition is of no defined material (i.e. is inclusive of entirely inorganic compositions, etc.), so there is nothing necessarily requiring "bake out". Also, whether this limitation is also intended to apply to the sintering, is ambiguous due to the phrasing.

While percentages are unitless quantities, for them to be meaningful, how they were calculated needs to be indicated. In **claims 22, 23, 25*, 26*, 28, 41, 42, 45* and 46*** (*some of the values), % by what (weight, atoms, volume, moles, etc.)? For example, in claim 22, 70% by weight Pd is entirely different value or quantity than 70% Pd by moles, etc.

3. The following is a quotation of the appropriate paragraphs of **35 U.S.C. 102** that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of **35 U.S.C. 103(a)** which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. **Claims 1, 3-5, 8, 11, 13, 15, 16, 27-31, 36-37, 39-46 & 49** are rejected under 35 U.S.C. **102(b)** as being anticipated by **MA et al** (6,152,987).

Claim 12 is rejected under 35 U.S.C. **103(a)** as being unpatentable over **MA et al** (6,152,987).

Ma et al teach forming a H-extraction module, where the substrate may be a porous metal (stainless steel) tube, that has been cleaned (a surface treatment), then oxidized, nitrated or carbonized to form a barrier layer. Thereafter, a membrane layer of Pd or Pd +Ag that may be 18-32 μm thick, with preferred alloy ratios of 75-77% Pd and 23-25 % Ag, is deposited by the exemplary method of electroless

plating, then the resultant membrane is typically rinsed in deionized water at 50-60^{O}C (reads on the generic, unspecified "thermal treatment" that has no particular results). Membrane deposition by other techniques, such as vacuum sputtering or spray deposition, are also noted as useful. Another embodiment separately plates Pd, then silver, followed by forming the alloy membrane thereof at 300-1000^{O}C in inert or H_2 atmosphere.

With respect to the probable product claims that require use of laser direct write or a metallic ink with metallic and carrier components, these are method limitations that do not provide any necessary structure to the product that is not already found in the structure of Ma et al's H-extraction modual, especially considering that the carrier in the ink, as read in light of the description is not intended to be a part of the resultant product. In Ma et al (987), see the abstract; figure 1; col. 1, lines 21-col. 7, line 40, esp. col. 1, lines 21-60; col. 2, lines 25-65; col. 5, lines 51-60+; and col. 7, lines 10-40.

While Ma et al. teaches various possible barrier layers on their substrate before deposition of their Pd or Pd+Ag layer, they do not discuss etching of the barrier layer before the Pd deposition. However, it is noted that applicant's barrier layer is of undefined material, and while it seems probable that its nonspecific diffusion barrier effects are intended to be analogous to those of Ma et al., to claimed etching of an unspecified material with specific agents, is fairly meaningless, especially when exactly what effect the etching is supposed to have on the unspecified materials is also absent. This aside, it may be observed, that after Ma et al. deposits an intermediate barrier layer from among their taught options (col. 5, lines 20-61), their exemplary Pd deposition sequence starts with immersing the substrate/intermediate layer in acidic $SnCl_2$ (e.g. a pretreatment before the Pd deposition & post-treatment after barrier layer deposition). While the overall composition of the $SnCl_2$ solution is not given, it would've been obvious to one of ordinary skill in the art to employ an aqueous solution of acidic $SnCl_2$, & in order for it to be acidic as taught when using $SnCl_2$, an obvious choice of acid would have included HCl, because of the ligands of the catalytic tin compound. Hence, the initial immersion treatment before the additional deposition

using $PdCl_2$ (e.g. the composition) would reasonably have included HCl, such that this acidic solution would reasonably have been expected by one of ordinary skill to etch something on the substrate (e.g. etch the surface by cleaning or helping to produce active sites for the Sn catalyst, etc.).

5. **Claims 1, 3-5, 11, 13, 15-18, 29-31 & 36-49** are rejected under 35 U.S.C. **102(b)** as being anticipated by **OGAWA et al** (5,782,960).

Ogawa et al teach making a tubular H-separation membrane, where a metal foil that may be 2-50μm thick, and that may be made of a composition of at least 60 wt.% Pd and additionally not more than 30 wt.% Ag, with an example of 77wt % Pd +23 wt. % Ag given, is bonded to a substrate that has holes (i.e. is porous), via diffusion bonding or brazing or seal welding. In Ex. 1, both diffusion bonding of the entire contact areas, and seal welding with a CO_2 laser are employed to produce a member that has "no leaks". Note the foil is disposed upon the surface and is or has a composition, with a coating reading on possible meanings of "leak-tight" coating formed through a series of thermal processing steps. The taught substrate is formed of a composite of steel plates, whose surfaces were treated by **etching** with a ferric chloride solution to provide holes, before the treatments involving the metal foil. In **OGAWA et al** (960), see the abstract; figures, esp. 2; col. 2, lines 54-63+; col. 3, lines 7-30; col. 4, lines 3-10; col. 5, lines 8-22 and 45-col. 6, line 46.

6. **Claims 2, 17-26, 36-49** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Ma et al**, in view of **Hu** (2001/0016236 A1).

Ma et al do not teach the use of a laser direct writing process, nor an ink composition, however they do teach that alternate membrane (Pd-Ag layer) deposition techniques may be used besides the exemplary electorless plating. **Hu** teaches a technique taught to be advantageous over electorless plating, as well as to be useful for catalysis/separation applications or Pd-based membranes for H-permeability, but does not provide a specific example of such use. The Hu technique may pretreat a substrate (possibly porous metal) to be coated with a metal layer with a photocatalyst coating, then with a solution containing

metal precursors, after which heat may be applied to evaporate liquid, and light that may be from a position-controlable laser beam to cause reduction to metal, and may be considered a laser writing process. The structure of the film will be selected according to end use and may be porous to dense depending on biological/organic components present, where sintering may be employed to remove organic or biological components. The technique may be used to make film from 1-5000nm (i.e. .001-5μm). In **HU**, see the abstract; [0005-7]; [0009-11]; [0016], [0018-19]; [0024-0026]; [0028-29]; [0031]; [0034-35].

It would have been obvious to one of ordinary skill in the art to apply the technique of Hu in the process of Ma et al for deposition of the Pd-Ag coating, because the primary reference suggests that alternate deposition techniques are applicable, where Hu provides motivation for use of the technique specifically due to their suggested enduses and teaching that it is advantageous over electroless plating, which is the exemplary technique used by Ma et al.

7. **Claims 1, 4, 13-16 & 27-28** are rejected under 35 U.S.C. **102(b)** as being anticipated by **Oyama et al**. (6,527,833 B1).

Oyama et al discuss tubular porous glass substrates, silica coated by CVD or previously by sol-gel, to produce H-selective permeability. Either technique involves thermal processing, where the sol gel one may repeat coating and thermal processes, and the chemical vapor deposition technique employs heating in an inert atmosphere lacking oxygen or steam, with preferred thin films on the order of 10-100 Angstroms, which is less than 20 μm. In OYAMA et al, see the abstract; figures; col. 2, line 49-col. 3, lines 22 and 65-col. 4, line 10; col. 53-68; col. 7, line 22-col. 8, line 40 and col. 10, lines 44-47.

8. **Claims 5-10 & 32-35** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Ma et al**, in view of **Dye et al** (6,214,090 B1) or **Peachey et al.**(5,738,708).

Ma et al do not teach a step that is a "polishing" step of an ion beam treatment or vapor deposition before depositing their metal chalcogenide (oxide barrier coat), however **Dye et al** or **Peachey**

et al, who are also teaching formation of analogous membranes, teach ion milling as a cleaning that may be used in conjunction with washing pretreatment before coating the core substrate with a catalytic metal, such as Pt or Pd, etc, possibly by vapor deposition techniques, which is not porous, but passes hydrogen. Either the ion milling or the vapor deposition metal step may read on the claimed 'polishing' due to expected effects and context. In DYE et al, see the abstract; col. 1, lines 10-17 and 36-col. 2, line 45; col. 3, line 11- col. 4, line 55. In PEACHEY et al, see the abstract; col. 2, line 36-col. 4, line 15.

It would have been obvious for one of ordinary skill in the art to apply additional layers and technique as used by Dye et al or Peachey et al, in the process of Ma et al, because the ion treatment technique is a cleaning technique taught to be desirable combined with Ma et al's suggested cleaning, and preceding the taught vapor deposition, which is desirable for its effects as a catalytic metal, and for the overall composite with the barrier layer for effecting reducing poisoning of the membrane. It is further note that the ion beam milling is preformed in the same chamber as the vacuum depositions of catalytic and oxide layers that as its name suggest, it causes removal of surface material, i.e. etching, and is old and well known for a technique to improve adhesion, hence would have been analogously obvious used between coating steps for similar surface activation effects. Peachey et al is noted to further use ion-assisted vapor deposition techniques for both catalytic metal and oxide buffer layer, and it was known in the art that such techniques may employ an ion beam simultaneously with vapor deposition, which sputters or etches materials simultaneously with deposition.

9. **Other art** of interest includes: **BOSSARD et al** (2004/0244589 A1), while published on 09/12/04 is noted to have a provisional parent with filing date of 6/4/2003, so as a potential 103(e) reference, especially relevant to claims 1, 3 and 5, 7, 13-18, 29-31, 36-47 & 49, but is presently redundant in view of the above rejections. Particularly, see the abstract; figures, esp. 5-9; [0018-19]; [0041-51]; [0060-71], esp. [0063], [0066], [0068].

ALLEN et al (6,077,621) is noted to have teaching is equivalent to dye et al. & peachy et al., as discussed above in section 8. Particularly, see the abstract; col. 1, lines 10-20; col. 3-5.

10. **Any inquiry** concerning this communication or earlier communications from the examiner should be directed to **Marianne L. Padgett** whose telephone number is **(571) 272-1425**. The examiner can normally be reached on M-F from about 9:00 a.m. to 5:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached at (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Marianne L. Padgett/
Primary Examiner, Art Unit 1792

MLP/dictation software

12/18 & 20/2009